Written Testimony of Joseph H. Bouton, Ph.D.
Subcommittee on Conservation, Credit, Rural Development and Research
June 23, 2004

The Samuel Roberts Noble Foundation is a private foundation located in Ardmore, Oklahoma. Since its founding in 1945, the Noble Foundation has conducted educational programs to assist farmers and ranchers in the southern Oklahoma and north Texas region as part of charitable mission. The Noble Foundation expanded its agricultural research operations through the creation of two research groups: a basic plant biology group, in 1988, and an applied group in 1997, the Forage Improvement Division.

Research in the Noble Foundation's Forage Improvement Division has centered on development of improved forage grass and legume cultivars for use by farmers and ranchers in the southern Great Plains. "Cultivars" are a group of plants that breed true for specific traits through generations of seed increase, such traits being governed by genes. Thus, cultivar development is the process of enhancing (or adding) genes and minimizing undesirable genes (and their related traits).

Dependability is the critical characteristic needed in the region's harsh environment. Therefore, our main target species are perennials such as tall fescue, bermudagrass, hardinggrass, western wheatgrass, alfalfa, and red and white clover. Target traits include drought and heat tolerance and pest resistance. Improving nutritive quality is another important trait.

We approach the incorporation of useful genes that govern these traits almost exclusively with conventional selection and breeding techniques. In this approach, we collect as much of the known plant germplasm, often from the USDA plant germplasm system, and screen it for the target traits. Sometimes, the traits are very complex or difficult to manipulate and biotechnology approaches become an option. For example, in many forage species, lignin is deposited along their cell walls resulting in a poor rate of digestion during rumen breakdown of the forage. Basic research by our Plant Biology Division identified two genes in the lignin pathway that when down regulated resulted in less lignin deposition. We have now successfully down regulated these genes in alfalfa and tall fescue with a concurrent increase in digestibility of the forage. This same approach is now being investigated with bermudagrass.

In May 2003, we co-hosted with Texas A&M University the Fourth International Symposium on Molecular Breeding of Forage and Turf in Dallas, Texas. There were approximately 200 scientists in attendance from 19 countries. Research talks were many and varied on every aspect of basic biotechnology. This symposium, and many others like it, is direct proof that basic research in biotechnology is intense and growing. Whether we will be able to deliver useful biotech traits for agricultural use is another matter. First, there has not been a new crop de-regulated in several years. I am defining a "new crop" as one that has never been in commercial production while containing a biotech trait. Since all our target species would represent "new crops" by that definition, then we are concerned that even doing all requisite safety trials may not be enough to

insure de-regulation. Second, two crops, creeping bentgrass and alfalfa, are currently being assessed by USDA-APHIS for de-regulation for the Roundup Ready gene, a 1980s technology that is currently found in millions of acres of corn, soybean, and cotton. Since alfalfa is one of our target species, and creeping bentgrass represents a perennial grass similar to many of our target grass species, we are watching very intently the final disposition of these two applications. The fact that the creeping bentgrass application has now been in the process longer than any crop to date is not encouraging.

It is hoped that the regulatory agencies will concentrate on assessing real versus perceived risks. At the end of the day, these agencies will need to make decisions on what are the real risks, establish a rigorous regulatory process to assess these risks, oversee the regulatory process in a fair manner, and make a decision. We can all then move forward based strictly on the value of the traits to the environment, the farmer, American agriculture, and all citizens of this country.

About The Samuel Roberts Noble Foundation

The Samuel Roberts Noble Foundation, Inc., a not-for-profit Oklahoma corporation and private foundation, operates in part to enhance agricultural resource management and plant productivity through consultation, demonstration, applied biotechnology, and basic research. Consistent with its founder's original vision, Noble is one of the nation's largest endowments whose charitable mission includes the conduct of research for agriculture enhancement. Noble was founded in 1945.

Noble's research operations are based on its headquarters campus in Ardmore, Oklahoma and on more than 15,000 acres located in southern Oklahoma. Noble conducts its agricultural and research operations through three operating divisions: Agricultural, Plant Biology, and Forage Improvement.

The **Agricultural Division** assists farmers and ranchers through a variety of services, including consultation, education, research and demonstration. The primary goal of this division is to serve farmers and ranchers within a 100-mile radius of Ardmore.

The **Plant Biology Division**, occupying more than 100,000 square-feet of laboratory and administrative space, performs basic research in plant metabolism and responses to pathogens and pests. Its focus in recent years has been on the understanding and improvement of legumes. With more than 18,000 species, legumes are second only to grasses in terms of economic importance worldwide. Moreover, legumes are an excellent source of protein and dietary fiber, which are usually deficient in the diets of people in developing nations. Using the model legume system *Medicago truncatula,* the division conducts research to enable the improvement of legumes, such as alfalfa, clovers, peanuts, soybeans, lentils, and chickpeas. Researchers believe their work in *M. truncatula* has the potential to significantly impact hunger and farming practices on a global scale.

The research of the **Forage Improvement Division** centers on the development of improved legume and grass forages for use by farmers and ranchers in the southern Great

Plains. The challenges faced by southern Great Plains agriculture can be broadly classified into concerns with cost, ease of use, dependability and environmental desirability of production. Improved forages can address each of these concerns. As part of a recent $85 million campus improvement project, a new 85,000-square-foot laboratory building, set for completion in October 2004, will provide state-of-the-art facilities in which the division can conduct its research. A recently completed 45,000 square-feet research greenhouse complex serves the Forage Improvement Division as well as the Agricultural and Plant Biology divisions.

Noble organizationally forms a "technology pipeline" uniquely capable—through a single entity—of taking discoveries from the bench of Plant Biology through trials and cultivar development in Forage Improvement to the hands of farmers and ranchers for evaluation through the Agricultural Division. From gene discovery to the farm or ranch, the Noble uses a focused, multidisciplinary organization to improve agriculture and its use, locally, regionally, and worldwide in accordance with its overall philosophy regarding the betterment of agriculture: science and biotechnology alone cannot improve agricultural productivity but must complement improvements and advancements in production or management techniques.

Noble employs more than 285 people from 16 countries, 70 of whom are PhDs. Noble scientists serve on the editorial boards of nine international journals, and the fourteen principal investigators of the Plant Biology and Forage Improvement divisions collectively hold more than ten adjunct professor positions at United States universities, including Oklahoma State University, Rice University, University of Georgia, University of Oklahoma, University of Texas, Texas A&M University, and Washington State University, as well as the University of York, York, UK.

In 2003, Noble scientists published more than 100 articles in peer-reviewed journals, including *Nature, Science, Proceedings of the National Academy of Sciences USA, Plant Cell*, *Plant Journal, Crop Science, Theoretical and Applied Genetics* and *Agronomy Journal.*

CURRICULUM VITAE

Joseph H. Bouton
Director, Forage Improvement Division
Samuel Roberts Noble Foundation
2510 Sam Noble Parkway
Ardmore, OK 73402
Phone no.: 580-224-6801
Fax no.: 580-224-6802
Email: jhbouton@noble.org

Education

B.S. Mississippi State University	1970	M.S. University of Florida	1974
B.S Mississippi State University	1972	Ph.D. University of Florida	1977

Positions

Assistant Professor, 1977-1983; Associate Professor, 1983-1988; Professor, 1988-2004. Forage Breeding and Genetics, Agronomy Department (now Department of Crop and Soil Sciences), University of Georgia, Athens, Georgia.
Director, Forage Improvement Division, Noble Foundation, 2004-Present.

Special Positions Held

Graduate Coordinator, Dept. of Agronomy, Univ. of Georgia, 1988-1990
Interim Dept. Head, Dept. of Crop & Soil Sciences, Univ. of Georgia, 1996-1997
Professore a Contratto, Universita degli Studi di Perugia, Perugia, Italy, Spring 1998
President, North American Alfalfa Improvement Conference, 2000-2002

Recent Awards and Professional Recognitions

Elected Fellow, Crop Science Society of America, 1991
Elected Fellow, American Society of Agronomy, 1992
Inventor of the Year, University of Georgia Research Foundation, 1993
AGHON, Honorary Member, University of Georgia, 1994
R. R. Hill, Jr. Research Award, North American Alfalfa Improvement Conference, 1994
Man of the Year in Service to Southeastern Agriculture, Progressive Farmer Magazine, 1995
Merit Award, American Forage and Grassland Council, 1995
Outstanding Research Award, University of Georgia Agricultural Alumni Association, 1996
Gamma Sigma Delta Senior Faculty Award, University of Georgia, 1997
Non-Resident Fellow, Noble Foundation, 1997-2000
Goddard Lecturer in Plant and Soil Sciences and Animal Science, Univ. of Tennessee, 2001
Creative Research Medal, University of Georgia, 2002
Carl Sprengel Agronomic Research Award, American Society of Agronomy, 2003

Professional Publications
Chapters of books written - 11
Technical papers, refereed - 86
Technical papers, non-refereed - 149
Non-technical papers – 5
Patents - 6
Invited lectures, seminars, or symposia presentations - 48
Other related oral, written, visual presentations, or products - 91

Most significant publications, patents, and presentation or products in literature:

Bouton, J.H. 1990. Alfalfa 'Alfagraze'. USDA Plant Variety Protection Certificate 9000155. Date issued: 31 July 1990.

Bouton, J.H., S.R. Smith, C.S. Hoveland, and M.A. McCann. 1993. Development of grazing tolerant alfalfa cultivars. p. 416-418. Proc. XVII International Grassland Congress, 8-11 February 1993. Palmerston North, New Zealand.

Brummer, E. C., J. H. Bouton, and G. Kochert. 1993. Development of an RFLP map in dipliod alfalfa. Theor. Appl. Gent. 86:329-332.

Smith, S.R., Jr., and J.H. Bouton. 1993. Selection within alfalfa cultivars for persistence under continuous stocking. Crop Sci. 33:1321-1328.

Bouton, J. H., R. N. Gates, D. P. Belesky, and M. Owsley. 1993. Yield and persistence of tall fescue in the southeastern coastal plain after removal of its endophyte. Agron. J. 85:52-55.

Bouton, J.H. 1996. Tall Fescue 'Jesup'. USDA Plant Variety Protection Certificate 9600391. Date issued: 10 February 2003.

Bouton, J.H., C.S. Hoveland, and R.N. Gates. 1997. Use of the grazing animal in forage breeding. p. 4,7-4,8. Proc. XVIII International Grassland Congress, 8-19 June 1997. Winnepeg, Manitoba, Canada.

Bouton, J.H., R.N. Gates, and P.R. Utley. 1998. Persistence and yield among nondormant alfalfas selected for grazing tolerance. J. Prod. Agric. 11: 314-318.

Bouton, J.H., C.S. Hoveland, D.R. Woodfield, and J.R. Caradus. 1998. Selection and testing of white clover germplasm derived from naturalized ecotypes. p. 33. In C.R. Grau (ed.) Proc. 15th Trifolium Conference, Madison, WI. 10-12 June 1998. Univ of Wisconsin, Madison.

Bouton, J.H., and S.R. Smith, Jr. 1998. Standard test to characterize alfalfa cultivar tolerance to intensive grazing with continuous stocking. p. A-8. *In* C.C. Fox, R. Berberet, F.A. Gray, C.R. Grau, D.L. Jessen, and M.A. Peterson (ed.) Standard Tests to Characterize Alfalfa Cultivars (Third Edition). North American Alfalfa Improvement Conference, Beltsville, MD. Available online at http://www.naaic.org (verified 11 February 2003)

Bouton, J.H., G.C.M. Latch, N.S. Hill, C.S. Hoveland, M.A. McCann, R.H. Watson, J.A. Parish, L.L. Hawkins, and F.N. Thompson. 2002. Re-infection of tall fescue cultivars with non-ergot alkaloid producing endophytes. Agron. J. 94:567-574.

Sledge, M.K., J.H. Bouton, W.A. Parrott, M. Dall'Agnol, and G. Kochert. 2002. Identification and confirmation of aluminum tolerance QTL in diploid Medicago sativa ssp. coerulea. Crop Sci. 42:1121-1128.

Bouton, J.H., and A.A. Hopkins. 2003. Commercial applications of endophytic fungi. p. 495-516. *In* J.F. White, C.W. Bacon, N.L. Hywel-Jones, and J.W. Spatafora (eds.) Clavicipitalean Fungi: Evoluntionary Biology, Chemistry, Biocontrol, and Cultural Impacts. Marcel Dekker, Inc., New York.

Recent Invited Research Presentations

2000 Southern Pasture and Forage Crop Improvement Conference, Raleigh, NC. Infection of tall fescue cultivars with non-toxic endophytes.

2000 American Seed Trade Association Annual Convention, San Francisco, CA. The future of proprietary alfalfa and perennial clover cultivars in the market).

2000 4th International Neotyphodium/Grass Interactions Symposium, Soest, Germany. The use of endophytic fungi for pasture improvement in the USA.

2000 Annual Meeting, American Society of Agronomy, Minneapolis, MN. Breeding for persistence in perennial temperate forage crops.

2001 XIX International Grassland Congress, Sao Pedro, SP, Brazil. Alfalfa.

2001 XIV Eucarpia Medicago spp. Group Meeting, Zaragoza, Spain. Combining the grazing tolerance trait with forage production in non-dormant alfalfa.

2001 Annual Meeting, American Society of Agronomy, Charlotte, NC. Selection and commercialization of tall fescue/endophyte associations.

2002 Arkansas Forage and Grassland Council, Little Rock, AR. New Forages Developed with the Farmer in Mind

2003 Universita degli Studi di Perugia, Perugia, Italy. Faculty Seminar. Breeding alfalfa in a technology era.

7

2004 5th International Neotyphodium/Grass Interactions Symposium. Fayetteville, AR. Endophytes in forage cultivars.

Contracts and Grants (past 5 years)

Total awards: $1,046,178 (Grants: $660,076; Contracts: $386,102)

Teaching and Advising

Courses taught, Univ of Georgia: Cytogenetics (AGY 889) 1979-90; Pasture and Forage Crops (AGY 321) 1981-86; Plant Breeding (AGY 404/604, CSS 404/604, CRSS 4040/6040) 1988-present.

Major Professor: 10 MS students; 4 PhD students

Committee on Agriculture
U.S. House of Representatives
Required Witness Disclosure Form

House Rules* require nongovernmental witnesses to disclose the amount and source of Federal grants received since October 1, 2002.

Name: Joseph H. Bouton, Ph.D.

Address: 2510 Sam Noble Parkway, Ardmore, Oklahoma 73401

Telephone: 580-223-5810

Organization you represent (if any): The Samuel Roberts Noble Foundation, Inc.

1. **Please list any federal grants or contracts (including subgrants and subcontracts) you have received since October 1, 2002, as well as the source and the amount of each grant or contract. House Rules do NOT require disclosure of federal payments to individuals, such as Social Security or Medicare benefits, farm program payments, or assistance to agricultural producers:**

Source: None **Amount:**

Source: **Amount:**

2. **If you are appearing on behalf of an organization, please list any federal grants or contracts (including subgrants and subcontracts) the organization has received since October 1, 2002, as well as the source and the amount of each grant or contract:**

Source: NSF (DBI-0110206) **Amount:** $108,006

Source: NSF (DBI-0109732) **Amount:** $1,756,464

Please check here if this form is NOT applicable to you:

Signature: Joseph Bouton

* Rule XI, clause 2(g)(4) of the U.S. House of Representatives provides: *Each committee shall, to the greatest extent practicable, require witnessess who appear before it to submit in advance written statements of proposed testimony and to limit their initial presentations to the committee to brief summaries thereof. In the case of a witness appearing in a nongovernmental capacity, a written statement of proposed testimony shall include a curriculum vitae and a disclosure of the amount and source (by agency and program) of each Federal grant (or subgrant thereof) or contract (or subcontract thereof) received during the current fiscal year or either of the two previous fiscal years by the witness or by any entity represented by the witness.*

PLEASE ATTACH DISCLOSURE FORM TO EACH COPY OF TESTIMONY.

Committee on Agriculture
U.S. House of Representatives
Required Witness Disclosure Form

(continuation)

2. If you are appearing on behalf of an organization, please list any federal grants or contracts (including subgrants and subcontracts) the organization has received since October 1, 2002, as well as the source and the amount of each grant or contract:

Source: NASA (NAG2-1518) Amount: $128,156

Source: DOE (DE-FG03-97ER20259) Amount: $73,332